**STATE OF VERMONT**
**PUBLIC SERVICE BOARD**

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| Amended Petition of Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. for amendment of their Certificate of Public Good and other approvals required under 30 V.S.A. § 231(a) for authority to continue after March 21, 2012, operation of the Vermont Yankee Nuclear Power Station, including the storage of spent nuclear fuel | )<br>)<br>)<br>)<br>)<br>) | Docket No. 7862 |

# DIRECT TESTIMONY OF WARREN K. BREWER ON BEHALF OF THE VERMONT DEPARTMENT OF PUBLIC SERVICE

October 22, 2012

Summary: Mr. Brewer's testimony presents the results of an analysis of the most recent decommissioning cost report prepared by TLG Services, Inc. for Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc., the "Decommissioning Cost Analysis for the Vermont Yankee Nuclear Power Station." Mr. Brewer provides costs for six possible decommissioning scenarios, four of which are based on operation of the Vermont Yankee Nuclear Power Station (the "VY Station") until 2032. Mr. Brewer concludes that the estimates used in that report fail to accurately predict the expected costs associated with decommissioning, and that the funding sources Entergy intends to rely on for decommissioning will accordingly be inadequate. Mr. Brewer's testimony also provides information regarding the financial requirements for the decommissioning of the VY Station, including storage of spent nuclear fuel.

Mr. Brewer sponsors the following exhibits:

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| Exhibit PSD-WB-01 | Resume of Warren K. Brewer |
| Exhibit PSD-WB-02 | ABZ Review of 2012 Vermont Yankee Decommissioning Cost Estimate, October 2012 |

Q1. State your name and business address.

A1. Warren K. Brewer, 4451 Brookfield Corporate Drive, Suite 107, Chantilly, Virginia, 20151.

Q2. On whose behalf are you testifying?

A2. I am testifying on behalf of the Vermont Department of Public Service.

Q3. What is your occupation?

A3. I am the President of ABZ, Incorporated ("ABZ"). ABZ is an engineering consulting firm providing related to the nuclear industry, including decommissioning cost estimating and planning and cost estimating and analysis with respect to spent fuel management and disposition. As President of ABZ, I am responsible for the quality of all work performed by ABZ and I am personally involved in all projects undertaken by ABZ. I have over 35 years of experience in the nuclear industry and have been involved in decommissioning cost estimating and planning since 1989.

Q4. Have you previously provided expert testimony?

A4. Yes. I have provided expert witness testimony before a state regulatory body, in arbitration, before the United States Tax Court and in numerous proceedings before the United States Court of Federal Claims. My resume, Exhibit PSD-WB-

01, contains a complete listing of the matters in which I have provided expert testimony.

Q5. What is your educational and professional background?

A5. I have a B.S. in electrical engineering from Louisiana Tech University and an M.S. in nuclear engineering from the Massachusetts Institute of Technology. I have also completed a graduate-level course of study in areas related to nuclear power and power plant design at the Bettis Reactor Engineering School.

After obtaining my Master's degree, I worked for slightly over 10 years at the Division of Naval Reactors, the joint Department of Defense and Department of Energy organization responsible for all aspects of design, construction, maintenance, and operation of nuclear reactors in US Navy ships and training facilities. I left the Division of Naval Reactors in 1986 and accepted a position with Pickard, Lowe and Garrick, a nuclear industry engineering consulting company. In late 1986, two colleagues and I formed ABZ and I have been employed at ABZ since that time.

Q6. What is the purpose of your testimony in this proceeding?

A6. The purpose of my testimony is to present the results of the ABZ analysis of the most recent decommissioning cost estimate for the VY Station performed by TLG Services, Inc. for Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc. ("Entergy"), the "Decommissioning Cost Analysis for the

Vermont Yankee Nuclear Power Station" (the "TLG Report"). Mr. Gregory A. Maret and I performed the ABZ Review of 2012 Vermont Yankee Decommissioning Cost Estimate, October 2012 ("ABZ analysis" or "our analysis"), attached hereto as Exhibit PSD-WB-02, with assistance from other ABZ personnel. Our analysis included evaluation of the estimated costs for decontamination and dismantlement as well as storage and management of spent nuclear fuel. In addition, we evaluated the decommissioning funding and financial assurance analysis described by Mr. Cloutier in his testimony on behalf of Entergy in this proceeding.

Q7. Please describe the scope of your analysis of the decommissioning cost estimate.

A7. Our analysis included review of the TLG Report, the supplemental data that formed the basis for that report, information and documents provided pursuant to the discovery process in this proceeding, Mr. Cloutier's prefiled testimony, and publicly available documents containing information relevant to the VY Station cost estimate. In addition, the 2001 and 2007 VY Station decommissioning cost estimates were included in our analysis to examine changes over time in the approach, details, and estimated cost for decommissioning the VY Station.

Q8. Generally, how was your analysis performed?

A8. We began our analysis by reviewing the estimate assumptions used in the TLG Report, both scenario dependent and scenario independent. Next we evaluated the cost details based on our experience, internal consistency, comparison to other estimates, and actual decommissioning data. After this review of the cost details, we analyzed areas of risk or uncertainty associated with the estimated cost. Finally, we evaluated the funding assurance calculations as described by Mr. Cloutier.

Q9. What scenario dependent assumptions did you analyze?

A9. The scenario dependent assumptions reviewed were the overall decommissioning approach and the spent fuel management timing and duration assumptions. The overall decommissioning approach is the selection of prompt dismantlement, referred to as DECON, or storage and delayed dismantlement, referred to as SAFSTOR. The spent fuel management timing and duration assumptions are the assumptions about when spent fuel will be transferred from the site to the Department of Energy ("DOE") and when the last of the spent fuel will be removed from the site.

Q10. What conclusions did you reach concerning the overall decommissioning approach?

A10. The TLG Report includes both DECON and SAFSTOR scenarios. It is a common practice for decommissioning cost estimates to evaluate both options. However, the estimate does not adequately address the advantages and disadvantages of the two options. Weighing the advantages and disadvantages of the two approaches, DECON is the preferable approach because it provides greater certainty and less risk, both technically and financially. SAFSTOR may provide some potential for reduced cost and greater financial growth, but at the price of greater uncertainty and more risk.

Q11. What are the uncertainty and risks associated with SAFSTOR?

A11. SAFSTOR presents risk that regulatory requirements may change and thereby increase decommissioning costs. SAFSTOR also exposes decommissioning to risk that sufficient qualified personnel will not be available at the time dismantlement is to be performed or that the qualified labor pool will be in such demand that costs will be higher than anticipated. Additionally, there is more uncertainty about the availability or unavailability of radioactive waste disposal sites decades in the future than there is today. Delay in decommissioning increases the risk that costs will be higher than anticipated, particularly with respect to radioactive waste processing or disposal. Finally, with SAFSTOR there is risk that the expected financial performance of the decommissioning trust fund will not be met. Of course, with respect to this last risk, the SAFSTOR period does provide a longer period for trust fund growth, but the fund earnings must outpace both the escalation of decommissioning costs as well as the costs associated with maintaining the plant in SAFSTOR.

Q12. Have you reached any conclusions about the spent fuel management assumptions utilized in the TLG Report?

A12. Three of the six decommissioning scenarios included in the TLG Report assume that DOE will begin accepting spent fuel in 2020. The other three scenarios assume that DOE will begin accepting spent fuel in 2042 or 2058. Considering a scenario assuming a 2020 DOE start date can be useful in understanding the sensitivity of decommissioning cost to changes in this assumption. However, a 2020 DOE start date is unreasonably optimistic based on the current state of the DOE spent fuel program, discussed in greater detail in the prefiled testimony of Mr. Bruce Hinkley filed on behalf of the Department of Public Service on this date. As such, the scenarios assuming a DOE start of 2020 do not represent a viable possibility.

Q13. Was that your only conclusion regarding spent fuel management assumptions?

A13. No. Three scenarios assume an end date of 2082 for transfer of the last spent fuel from the site. I understand that this end date is intended to be consistent with completion of the decommissioning within sixty years following final plant shutdown. However, if one is interested in understanding the range of decommissioning possibilities consistent with this sixty-year limitation, a later and more conservative date could have been used for two of the subject scenarios, scenario 4 and scenario 6. As modeled by the TLG Report, scenarios 2, 3 and 4 indicate that decommissioning can be completed about six months after final fuel removal. Since it is assumed that spent fuel will be transferred to dry storage within about five years after final shutdown, the decommissioning of all but the dry storage facility can be completed while fuel remains on-site. The date of removal of the last fuel assembly could be as late as the end of 2090 while allowing completion of decommissioning within sixty years. Assuming an end of 2090 date for the last fuel transfer would add about 7.75 years of dry storage costs to the estimates for scenario 4 and scenario 6. The added cost of this longer spent fuel storage would be about $54 million including contingency.

Q14. What scenario independent assumptions did you evaluate?

A14. The ABZ analysis included evaluation of assumptions concerning radioactive waste disposal, disposal of other decommissioning waste, including hazardous materials, and the general scope of site restoration. Our analysis also included evaluation of the allocation of estimated costs to the categories of license termination costs, spent fuel costs and site restoration costs.

Q15. Will your testimony address all of these areas?

A15. No. My testimony will address the radioactive waste assumptions and the funding allocation assumptions. Mr. Maret will address the ABZ analysis of the other assumptions mentioned above.

Q16. What assumptions did you analyze regarding radioactive waste disposal?

A16. We evaluated the radioactive waste disposal rates, the waste packaging density, and the use of waste processing in addition to direct disposal.

Q17. What specifically did you evaluate with regard to waste disposal rates?

A17. We analyzed two areas relating to waste disposal rates. The first was the rate assumed for disposal of Class A low-level radioactive waste (LLRW). The second was the rate for disposal of Greater Than Class C (GTCC) low-level radioactive waste.

Q18. What was the result of the analysis for the assumed rate for Class A LLRW?

A18. The TLG Report assumes rates for Class A LLRW disposal based on disposal of waste at the Envirocare site based on an existing agreement with Energy*Solutions*, the owner of that waste site. This assumption appears to be contrary to Vermont's participation in the Texas waste compact. Vermont's participation in the Texas compact requires all waste to be disposed of at the Texas compact site, Waste Control Specialists, LLC (WCS) unless an exemption is obtained from the Texas compact commission. Entergy does not have an approved exemption at this time for future waste disposal. Further, it is doubtful that such an exemption would be granted since the rates for all compact members and financial viability of the WCS site could be significantly affected by allowing the large volume of waste from the VY Station decommissioning to be diverted to another disposal site.

Thus, in the absence of an exemption from the Texas compact commission, the WCS Class A disposal rates should be assumed. Interim rates published in August 2011 for the WCS site list a rate of $150 per cubic foot for "routine" Class A waste. Applying this rate for all Class A waste in the TLG Report estimate would add about $17.4 million including contingency to the cost. Subsequent to the issuance of the TLG Report, WCS published newer rates. However, the detail in the VY estimate does not support readily applying these rates.

Q19. Do you have any other concerns about the use of the Envirocare rates for estimating the cost of Class A LLRW disposal?

A19. Yes. The Energy*Solutions* agreement has a fixed term and would require renegotiation (once or multiple times) if the VY Station is not decommissioned prior to the expiration of this term. Renegotiation introduces risk, as it could result in unexpected price increases or termination of the agreement. The agreement also contains provisions for certain predetermined price increases, allows for other price increases due to changes in waste site operating costs such as taxes, and contains provisions for termination of the agreement.

Q20. What were your findings with respect to GTCC waste disposal rates?

A20. The rate reflected in the TLG Report is too low. The TLG Report assumed that GTCC waste will be packaged in containers similar to those used for spent fuel and that the disposal rate will be equivalent to that for acceptance of spent fuel by

DOE. The rate reflected in the TLG Report can be calculated to be about $2,760 per cubic foot. However, my analysis for the rate, consistent with the TLG Report's assumptions about packaging and basis for the rate, results in a minimum rate of just under $8,200 per cubic foot. Adjusting the TLG Report GTCC disposal cost to be consistent with this rate would add about $3.8 million to the TLG Report's decommissioning cost estimate. Additionally, although the connection between GTCC disposal cost and spent fuel disposal cost is a common estimating assumption, there is no certainty as to how the rates might compare. No suggested or proposed rate for GTCC disposal has been published, and no method for setting the GTCC disposal rate has been proposed to date. Because of the level of uncertainty in the GTCC disposal rate, I believe a contingency of 50 percent would be more appropriate than the 15 percent included in the TLG Report estimate. Adjusting the rate and providing a 50 percent contingency would increase the TLG Report's decommissioning cost estimate by about $5.8 million.

Q21. What is waste packing density?

A21. The Class A LLRW waste disposal rates for both Envirocare and WCS are specified as dollars per cubic foot. However, the disposal cost in the TLG Report was calculated based on a rate of dollars per pound. The connection between these two types of rates is the assumed waste packing density. From the details of the TLG Report it is clear that for plant system removal waste such as piping, valves, pumps, and other components, the assumed packing density was 80 pounds per cubic foot. If this assumed density is changed, the cost of Class A waste disposal would change.

Q22. What is your conclusion about the assumed 80 pounds per cubic foot waste packing density?

A22. This is an aggressively high density. Evaluation of the types of waste involved indicates it could take significant effort to achieve this assumed density. Also, this assumed density is higher than what has been achievable in actual decommissioning projects. For example, average densities of approximately 48 pounds per cubic foot were achieved in the Yankee Atomic decommissioning project. I believe that a waste density of 48 pounds per cubic foot would be a more appropriate assumption. Use of this rate would add about $10.9 million, including contingency, to the TLG Report's decommissioning cost estimate.

Q23. Do you have any other concerns about the waste packing density?

A23. The higher the density one wishes to achieve, within the range of possibility, the greater the amount of labor needed to support the packaging. The TLG Report calculations include packing labor hours. However, it does not appear that these hours translate to costs in the estimate. Further, it does not appear that the labor for packaging is included in plant staff positions. Finally, the estimated packaging labor hours do not seem consistent with a high density such as that assumed by the TLG Report. Based on review of the TLG Report calculations, a single worker would be assumed to package 7,206 pounds of waste in about three hours, while deciding how to pack odd shapes to achieve the 80 pound per cubic foot density. At the density assumed by the TLG Report, this waste would fill a container three feet wide by ten feet long by three feet high. This is simply not reasonable.

Q24. Please explain what waste processing means.

A24. Waste processing is an alternative to direct disposal of LLRW. Specifically, lightly contaminated LLRW is sent to a processor that uses a variety of methods to treat the material, ultimately enabling some of it to be disposed of as non-radioactive. The remainder of the LLRW is sent to an LLRW disposal site. The TLG Report assumes a large amount of the contaminated material is sent to a waste processor rather than being sent to a LLRW disposal site.

Q25. What is your view on the assumption in the TLG Report that waste would be sent to a waste processor?

A25. In general, this is a reasonable and accepted assumption, but not as applied in the TLG Report. The actual application of a waste processing approach would require someone to separate the two waste streams as waste is generated. Specifically, there would be labor expended to determine which material is packaged for shipment to a processor and which material is packaged for shipment to a LLRW disposal site. No such costs for labor are included in the TLG Report. The TLG Report calculations reflect assumptions that make such separation of material more difficult. For example, inventories for some areas include single items with the assumption that some fraction of the item will be processed and some part of the item will be disposed of at a waste facility.

Q26. Do you have any other observations about the assumptions concerning the use of a waste processor?

A26. Yes. The TLG Report assumes that the split between waste sent to a processor and waste sent to disposal is different for DECON and SAFSTOR decommissioning scenarios. However, I have seen no data or calculations to support the way in which the split changes based on which scenario is utilized. In the 2007 estimate there did not appear to be a substantial difference in the split for DECON versus SAFSTOR. Also, I compared the per cubic foot rate for waste processing cost in the 2007 estimate with that in the 2012 estimate. In the 2007 estimate the processing costs are equivalent to a rate of about $86 per cubic foot while in the 2012 estimate the rate would be about $66 per cubic foot. This implies that waste processing is substantially cheaper in 2012 than it was in 2007. I am unaware of any data or explanation that would support such a large decrease. If the waste processing costs were adjusted to use the same rate as was used in 2007, the TLG Report's decommissioning cost estimate would increase by about $9.3 million including contingency.

Q27. What is meant by allocation of costs in the context of a decommissioning estimate?

A27. When discussing decommissioning costs, allocation of costs is the assignment of various portions of the total estimated costs to the categories of license termination costs, spent fuel costs, or site restoration costs. License termination costs are the costs for performing the necessary work to remove radioactive hazards from the site to the level necessary to obtain Nuclear Regulatory Commission ("NRC") approval to terminate the facility's NRC license and allow the site to be used without any further regulation by the NRC. Spent fuel costs are the costs necessary to support safe storage of spent nuclear fuel until it is removed from the site. Site restoration costs are the costs for any other work needed to remove structures and any non-radiological hazards from the site. The allocation of costs does not affect the total decommissioning costs, but simply establishes how the total is divided into the three categories.

Q28. What is the significance of the allocation of costs?

A28. NRC regulations limit the use of decommissioning trust funds for license termination activities. The NRC also requires periodic reporting by licensees to provide assurance that adequate funding is available for license termination activities. Mr. Cloutier has testified that he expects spent fuel costs will be recovered from DOE and that this expectation has been reflected in the funding analysis he performed. Funding analyses based on such an assumption will not be accurate if costs are not properly allocated.

Q29. What is the result of your evaluation of allocation of costs in the TLG Report?

A29. There are instances in which the allocation is incorrect and instances in which the allocation of costs is inconsistent between scenarios or even between periods within a scenario estimate. Specifically, I have evaluated allocation of costs for NRC fees, security staffing, and utility staffing.

Q30. What conclusion have you reached concerning allocation of NRC fee costs?

A30. Costs for NRC fees are included in the TLG Report for all scenarios. There are two types of NRC fees included. The first is the annual license fee or Part 171 fee. The second type is for-service fees or Part 170 fees. Both types of fees are included in one category in the TLG Report. The allocation of NRC fees is not consistent across all scenarios or for all periods within the estimate for a scenario. Further, in some instances the TLG Report allocation does not appear consistent with the basis of the fees.

Q31. Please explain the basis for this conclusion.

A31. Since 1999, the NRC regulations impose a Part 171 annual fee on permanently shut down facilities in a decommissioning status, but only as long as spent fuel is being stored on-site. As a result, one possible allocation of these costs would be to simply allocate all Part 171 costs as spent fuel costs. However, even with performance by DOE to accept spent fuel, some fuel would remain on site for approximately five years after final shutdown. Therefore, in light of the TLG Report assumption regarding recovery of spent fuel costs from DOE, it is appropriate to use a different allocation. Part 171 fees could be allocated to spent fuel costs only after the initial fuel storage period. The TLG Report allocation is not consistent with either of these approaches. For example, in three of the TLG Report scenarios (1, 5 and 6), all of the NRC fees are allocated as license termination costs. This is not appropriate. It is my opinion that the most appropriate allocation of Part 171 fees is the second alternative. With this allocation, Part 171 fees are allocated to license termination through period 2a of the SAFSTOR scenarios or period 2b for DECON scenarios. These periods end about 5.5 years after plant shutdown. After that time, Part 171 fees should all be allocated as spent fuel costs.

Q32. What about the Part 170 NRC fees?

A32. The allocation of these fees depends on the activities for which such for-service fees where estimated. This level of detail for the TLG Report was not made available. As a general rule, Part 170 fees estimated based on activities related to spent fuel storage or transfer should be allocated as spent fuel costs, with the remainder allocated as license termination costs.

Q33. What is your opinion regarding the allocation of security staff costs?

A33. Even in the absence of spent fuel on site, there would be some level of security necessary, just as for any industrial site. This level of security is often referred to as “industrial security.” This level of security prevents theft and entry of intruders who could be harmed resulting in possible liability for the site owners. With spent fuel on site, the NRC mandates a greater level of security, which I will refer to as “nuclear security.” The allocation of security costs in the TLG Report is not consistent with these facts. As an example, the activities and plant condition is the same in period 2a of both scenarios 1 and 2. However, in scenario 1 the security costs for this period are allocated partly to license termination and partly to spent fuel. There is no reason for this difference.

Q34. How do you conclude security staffing costs should be allocated?

A34. A reasonable allocation of security staffing costs should be based on the reasons for varying levels of security. Specifically, until completion of license termination activities, excluding the dry storage facility, costs consistent with industrial security should be allocated to license termination costs. For periods during which site restoration activities are performed, again excluding work related to the dry storage facility, costs consistent with industrial security should be allocated as site restoration costs. All other security costs should be allocated as spent fuel costs. Because of the inconsistent allocation of costs in the TLG Report, applying this method of allocation would allocate less cost to spent fuel for four of the six estimate scenarios presented and allocate more cost to spent fuel in two of the scenarios presented.

Q35. Is the situation concerning allocation of utility staff costs different from allocation of security staffing?

A35. The situation is similar in that the allocation of utility staff costs is not consistent between scenarios in the TLG Report. For example, period 2a in both scenario 1 and scenario 2 is the same with respect to activities and spent fuel storage. Staff costs for period 2a of scenario 1 are split between license termination and spent fuel, but for period 2a of scenario 1 all utility staff costs are allocated as spent fuel costs. The situation regarding utility staff costs differs from the situation with respect security staffing because the allocation can be more subjective.

Q36. In what way can the allocation of utility staff costs be more subjective?

A36. During any periods in which the plant is maintained in a SAFSTOR condition or is actively being decommissioned and spent fuel is being stored on-site, it could be judged that spent fuel is the primary activity, with staff necessary for fuel storage allocated as spent fuel costs, and any remaining staff allocated as license termination costs. Alternatively one could judge that license termination is the primary activity and assign all staff needed to support license termination activities as license termination costs, with any remaining staff costs allocated as spent fuel costs. The difference in these two approaches can be illustrated by considering health physics staff. Both license termination and spent fuel storage require health physics support. However, the health physics support for long term spent fuel storage is small compared to license termination. Thus, if license termination is considered the primary function, it may be determined that no incremental health physics staffing is needed to support spent fuel storage, thereby resulting in no additional cost to be added to the decommissioning estimate. If spent fuel storage is considered to be the primary activity, some health physics staff would be allocated as spent fuel costs.

Q37. What do you conclude is the appropriate way to allocate utility staff costs?

A37. The staff utility costs should be allocated consistent with the following assumptions. For DECON scenarios, decommissioning—that is, license termination or site restoration as applicable—should be considered the primary activity through the end of site restoration activities, not including work related only to the dry storage facility. Spent fuel storage would be considered the primary activity for all other times. This is appropriate because the duration of license termination and site restoration is based on the time needed for those activities and not controlled by how long spent fuel will remain on-site. For SAFSTOR scenarios, until the completion of site restoration including the SAFSTOR period, license termination or site restoration should be considered the primary activity. While this is essentially the same as for DECON options, the important point is that the SAFSTOR period treated the same as periods of active decommissioning. The basis for this treatment is that the length of any SAFSTOR period is a utility decision that is not dictated by the presence of spent fuel.

Q38. Do you have any additional conclusions with respect to allocation of costs?

A38. There are other examples of inconsistency of allocation of costs in the TLG Report. Scenarios 4 and 6 have the same plant shutdown date and length of spent fuel storage. However, in the TLG Report about $32 million more is allocated to spent fuel storage in scenario 6 compared to scenario 4. A similar situation exists in comparing scenarios 3 and 5; in that case about $38 million more is allocated as spent fuel costs in scenario 5. Further comparison of scenarios 1 and 2, comparison of scenarios 3 and 4 and comparison of scenarios 5 and 6 each allow for the calculation of annual cost for dry fuel storage. The calculated dry storage cost for based on each of these comparisons is different. Calculating different costs for each of the three scenario comparisons indicates an inconsistent allocation of costs.

Q39. What estimate details did you analyze?

A39. Our analysis included staffing costs, other period dependent costs, and activity dependent costs.

Q40. Did you reach a general conclusion concerning staffing costs?

A40. My primary conclusion is that based on the staffing levels over time and evidence from actual decommissioning projects, the staffing costs are likely understated in the TLG Report.

Q41. What is significant about the staffing levels over time?

A41. The staffing levels over time indicate significant changes without substantial cost for relocation, training, or severance. The staffing levels included in the TLG Report do not appear to account for an orderly ramp down or ramp up of staff over time. For SAFSTOR scenarios where staff is reduced to a very low level and many years later dramatically increased, the TLG Report does not appear to include costs associated with acquiring and training staff to ensure that the staff have adequate knowledge of the VY Station, decommissioning, and local requirements.

Q42. What decommissioning experience supports your conclusion?

A42. While I believe that it has generally been the case in decommissioning projects conducted to date that staffing costs have been underestimated prior to the actual work being performed, the current decommissioning of the Humboldt Bay facility by the Pacific Gas and Electric Company ("PG&E") provides a recent example. In a 2006 TLG Report estimate for this project the staff costs were estimated at $107.6 million after escalation to 2010 dollars. After the start of the project, PG&E increased the expected staff cost to $168 million in 2010 dollars. The actual costs have exceeded even this updated cost. The TLG Report contains no data to explain why the staffing assumptions included therein contain adequate margins to prevent a similar experience at the VY Station.

Q43. Do you have any additional comments concerning staff costs?

A43. First, the TLG Report contains no consideration of pre-shutdown planning. Such planning is necessary to allow transition from an operating status and commencement of decommissioning activities to be accomplished as quickly as practicable. While such planning activities can be financed as an operating expense prior to shutdown, they can also be a decommissioning expense. There is no evidence in the TLG Report regarding how costs for such work are assumed to be handled. Second, the TLG Report states that staff reduction will be handled by reassignment and outplacement with no costs. This seems unlikely. Other decommissioning projects have used substantial retention payments to keep workers and have provided extensive services to facilitate worker transition other employment. Entergy may well have substantial employment opportunities but not necessarily in Vermont. While reasonable estimators can debate the level of costs for retention and employment assistance, zero is not a reasonable estimate. Finally, there appear to be inconsistencies in the pay rates used in the TLG Report.

Q44. What inconsistencies in pay rates were identified?

A44. There are common types of personnel included in utility staff and labor included in unit cost factors for activity costs, such as health physics technicians, laborers, craft labor, and craft labor supervisors. The assumed rates for these types of personnel in the TLG Report are different when used for calculating staff costs versus unit cost factors. For health physics technicians, the rate used for staff costs is about 150 percent of the rate used in unit cost factors. For the other three categories, the rate used for staff costs is less than that used for unit cost factors. In the absence of data to justify these differences or to support selection of one rate over the other, the conservative approach would be to use the higher rate for each personnel category.

Q45. Did you analyze other period dependent costs?

A45. Yes. Evaluation of the other period dependent costs resulted in conclusions about the estimated NRC fees and energy costs.

Q46. What are your conclusions about estimated NRC fees?

A46. The estimated NRC fees are too low. The TLG Report estimates NRC fees based on the annual fee amount and the hourly rate charged by the NRC for for-service activities. In both cases the estimates contained in the TLG Report are based on fiscal year 2010 values, not fiscal year 2011 values. The fiscal year 2010 annual fee was $148,000 while the fiscal year 2011 annual fee was $241,000. The history of this fee shows that has been volatile. For fiscal year 2012, the fee was reduced to $211,000, but has earlier been over $300,000. The most conservative approach would be to use the highest annual fee that has been charged. However, because of the volatility of the fee, it may be more reasonable to use a value equal to the average of the fee over a period of time. The average annual fee over the five-year period from 2007 to 2011 was $161,000 per year. At minimum, an annual fee of $161,000 should be used. Using this average would add about $650,000 to the decommissioning cost estimate contained in the TLG Report. Use of the 2011 value would add about $4.6 million. With respect to the NRC hourly rate, there is no similar volatility and the fiscal year 2011 value of $273 per hour should be used rather than the fiscal year 2010 value of $259 per hour.

Q47. What are your observation regarding energy costs?

A47. Comparison of energy costs for various scenarios indicate that such costs have not been consistently estimated. Scenarios 1 and 2 have identical energy costs even though the total duration of scenario 2 is 10 years longer than scenario 1 and the fuel storage period in scenario 2 is 37 years longer. Scenarios 3 and 4 have the same estimated energy costs even though the duration of scenario 4 is 22 years longer.

Q48. Did you review detailed activity costs?

A48. Yes. I have comments concerning the estimated costs for reactor vessel and reactor vessel internals costs, other radioactive system removal, and asbestos remediation. I also have comments concerning five other activities for which there appears to be no cost included in the estimate.

Q49. What are your observations concerning the estimated costs for reactor vessel and reactor vessel internals related work?

A49. The reactor vessel and reactor vessel internals costs seem low for the SAFSTOR scenarios. There have been several decommissioning projects of large pressurized water reactors. In general, the cost of reactor vessel and reactor vessel internals work in these projects substantially exceeded the costs estimate before the project. Unlike pressurized water reactors (PWR), no large boiling water reactor (BWR) has been decommissioned to provide data on such work. However, the current decommissioning of a small BWR, Humboldt Bay, can provide some insight. Humboldt Bay was in a SAFSTOR condition for many years prior to the start of the decommissioning. The estimated cost for the reactor vessel and reactor vessel internals work at Humboldt Bay is expected to total about $49 million. Given the much larger size of the VY Station, the approximate $40 million estimate for reactor vessel and reactor vessel internals, not including GTCC disposal, in the SAFSTOR scenarios is inadequate. A cost $20 to $25 million greater than that included in the TLG Report for DECON scenarios is more appropriate for use in the SAFSTOR scenarios.

Q50. Did you review costs for work to remove other large radioactively contaminated components?

A50. Yes, costs for removal of all systems and components were reviewed. The related work includes the removal of a several large contaminated components. Many of these components will be contaminated in a BWR but not in a PWR and thus, the history of PWR decommissionings provides no direct data to use as benchmarks. Included in these other components are the main turbine and main condenser. These are very large components contributing over 100,000 cubic feet of waste with a weight of about 4.7 million pounds. The total removal cost, not including waste and packaging, is only about $700,000. Given the size of these components, this estimated cost is likely to be low compared to the overall estimated cost of this work.

Q51. You also indicated you had comments concerning asbestos remediation. Please explain your findings related to asbestos remediation.

A51. Each scenario analyzed in the TLG Report includes costs for asbestos remediation. The cost for this work in the SAFSTOR scenarios is greater than in the DECON scenarios. There is no reason to conclude that the asbestos remediation would be more costly in SAFSTOR than in DECON.

Q52. Do you have any additional comments concerning activity costs in the TLG Report?

A52. As mentioned earlier, there are four activities discussed in the TLG Report of the VY Station decommissioning cost estimate but for which I could locate no costs in the estimate. These are clean concrete disposal, temporary facilities, modification of site structures, and temporary or permanent shielding. Construction of temporary facilities, reconfiguration or modification of site structures and design and fabrication of temporary and permanent shielding is discussed in Section 2.1.2 of the TLG Report. However, I cannot identify cost estimate line items that clearly include these activities.

Q53. You also mentioned clean concrete removal. Please explain.

A53. The TLG Report assumes that most of the concrete in buildings that will be removed will be clean and will be disposed of off-site. However, the TLG Report does not appear to contain any costs for this disposal. If it is being assumed that there is some value of the clean concrete waste that is assumed to offset the disposal cost, this should be clearly stated in the estimate along with the basis for the assumption.

Q54. Describe decommissioning funding analysis.

A54. In simplest terms, funding analysis is a process by which the future estimated cash flow for decommissioning is compared to the future assets of the decommissioning trust fund to answer a variety of questions. The analysis can be performed to demonstrate that the fund will be sufficient, to determine what additional funds need to be committed or to determine the minimum fund performance that would predict adequate future assets. From the description provided by Mr. Cloutier, it appears that his funding analysis was performed to determine what real rate of return was necessary in order for the VY Station decommissioning trust fund to provide sufficient assets to fund any of the scenarios in the TLG Report. Since decommissioning funding analyses are prepared as current fixed year dollar estimates, any funding analysis will require escalating the resulting cash flow to a year of expenditure cash flow. Such escalation is dependent on the indices chosen for use in the escalation of costs. Mr. Cloutier does not identify the specific indices used in his analysis and instead focuses on the required real rate of return needed—that is, the increment by which the trust fund earning must exceed cost escalation. Ultimately one must determine if such a real rate of return is reasonable to expect, which requires knowledge of the assumed cost escalation.

Q55. Do you have an opinion about the appropriate way to escalate the decommissioning cash flow for funding analysis purposes?

A55. The NRC biannually publishes the NUREG-1307, which provides the required escalation factors for use in funding assurance calculations relative to the NRC minimum decommissioning funding. Review of the NUREG-1307 information for the period of 2002 to 2012 indicates that an annual rate of escalation for decommissioning costs over that period would be 5.78 percent per year.

Q56. What is significant about this cost escalation rate?

A56. Mr. Cloutier does not identify the escalation rate or rates used in his funding analysis. He does identify the rate of return from the decommissioning trust fund over the period of 2002 to 2012 as 5.42 percent per year as well as the required rate of return above escalation. He asserts that the required real rates of return are reasonable given the fund performance. However, if the fund performance is compared to the escalation based on NUREG-1307, the real rate of return over the 2002 to 2012 period is negative 0.36 percent. This would not be acceptable to demonstrate adequate funding.

Q57. Do you have any other comments on the funding analysis?

A57. The TLG Report does not address the potential future liability for transfer of spent fuel to DOE. The United States Court of Appeals for the Federal Circuit has held that costs for loading fuel to DOE have been deferred and that these costs will have to be paid when DOE performs. Mr. Cloutier has testified that all future spent fuel cost are expected to be recovered from DOE and included this assumption in his funding analysis. There is no indication that the potential future liability for loading fuel to DOE has been considered in his funding analysis. Finally, it is unclear that his funding analysis considers the decommissioning fund asset composition in future years. Typically, utilities plan to shift decommissioning fund assets away from equities to asset types with less risk but also lower returns. Therefore, it is unclear that the 2002 to 2012 fund return should be considered representative of the future returns over the life of the fund.

Q58. Have you considered uncertainties in the TLG Report decommissioning cost estimate?

A58. There are uncertainties with respect to spent fuel storage, regulatory changes, and availability of labor. These uncertainties have been discussed earlier in my testimony with one exception. That exception has to do with the method of dry fuel storage.

Q59. What is the uncertainty related to the method of dry fuel storage?

A59. The TLG Report assumes that after shutdown the spent fuel remaining in the spent fuel pool will be transferred to dry storage using Holtec casks similar to those already in use at the VY Station. The Holtec casks each hold 68 spent fuel assemblies. DOE has had two programs for development of casks for storage, transportation and disposal of spent fuel. In both instances, the BWR cask being designed had a capacity of 44 assemblies. If such a cask were ultimately developed, there may be incentive to use it for storage of spent fuel, but it would require a large dry storage facility and loading of more casks.

Q60. You have discussed the results of some comparisons between the 2007 and 2012 TLG reports regarding decommissioning of the VY Station. Are there any other results of such comparisons you would like to discuss?

A60. Yes. The comparisons performed indicate inconsistencies with the allocation of costs and costs for waste disposition as well as other specific costs.

Q61. What were your conclusions from comparing the 2007 and 2012 reports with regard to allocation of costs?

A61. I compared the 2007 and 2012 TLG reports in terms of assumptions about decommissioning approach, timing, and length of spent fuel storage. In comparing the total costs, the costs in the 2012 TLG Report were consistent with the costs in the 2007 TLG report assuming a cost escalation greater than that based on the change in Consumer Price Index ("CPI"), but less than the escalation that would be predicted based on the NRC's NUREG-1307. However, subtotals for license termination costs, spent fuel costs, and site restoration costs do not change in a predictable or readily explainable way. Specifically, in comparing the 2012 report scenario 2 with the 2007 report scenario 7, the license termination total increased by about 10 percent more than would be calculated based on escalation consistent with NUREG-1307. The spent fuel costs, however, decrease by about 22 percent from 2007 to 2012 compared to what would be estimated using NUREG-1307 escalation. The site restoration costs increased by less than CPI escalation. The comparison of the 2007 report scenario 8 and the 2012 report scenario 6 have similar results except that the 2012 spent fuel costs are less than the 2007 costs without any escalation.

Q62. Explain the results of your comparison of the 2007 and 2012 estimates with regard to waste disposition costs.

A62. Waste disposition cost were considered to be the sum of waste disposal and waste processing costs. Comparing these costs in the 2007 report scenario 7 and 2012 report scenario 2, the waste costs decreased by about 66 percent compared to what would have been determined based on NUREG-1307 escalation. In fact the unadjusted 2007 cost is greater than the 2012 cost. Similar results are obtained in the comparison of the 2007 report scenario 8 with the 2012 report scenario 6 and the comparison of scenario 4 from both estimates. There is no explanation given for the significant decrease in waste costs.

Q63. What other costs did you compare?

A63. The costs for transportation, packaging, corporate A&G, and surveys were compared. In all cases, these costs increased by two to three times what would have been expected assuming escalation consistent with NUREG-1307.

Q64. Did you perform any additional evaluations?

A64. I also evaluated Mr. Cloutier's testimony, and am concerned that that it and the TLG Report may understate the actual decommissioning costs for the VY Station. Specifically, Mr. Cloutier offers opinions concerning savings from experience gained in other decommissioning projects, fleet operation of spent fuel storage, maturation of DOE spent fuel planning, and recovery of spent fuel costs from DOE.

Q65. What was the conclusion with respect to savings from experience gain from other decommissioning projects?

A65. Mr. Cloutier testified that the VY Station would benefit from the decommissioning of other Entergy plants. Mr. Cloutier appears to be stating that the only question is the magnitude of the benefit that will be gained. Mr. Cloutier states this benefit will come from experience decommissioning the Fitzpatrick and Pilgrim plants. While experience from prior decommissioning work can result in benefits to later projects, the assertion that the VY Station will benefit is dependent on significant assumptions that may prove untrue.

Q66. Why are the potential savings uncertain?

A66. Unless decommissioning activities are conducted reasonably closely in time, the experience at other sites may not be preserved in a way that allows any substantive benefit. If there is significant time lapse between projects, as there might be under numerous scenarios, the knowledge gained from a prior project may not be adequately recorded or available many years later, particularly in sufficient detail to be a substantial benefit. Any experience not recorded but that might be obtained from the personnel involved in the earlier work would likely not be available decades later. Also, there is no reason to believe that the VY Station would not be the first plant decommissioned. If this were true, then Pilgrim or Fitzpatrick rather than the VY Station would gain the benefit of any experience in decommissioning. If Entergy undertook a plan to sequence the decommissioning of these three plants to maximize the benefit of experience, the specific location of each plant in the sequence would affect how that plant would benefit from lessons learned. In devising the sequencing of decommissioning the plants there would be competing interests of maximizing the financial interests of Entergy and maximizing the financial interests of Vermont, New York, or Massachusetts.

Q67. Do you have any further assessment concerning Mr. Cloutier's testimony about the potential savings from lessons learned?

A67. Mr. Cloutier states that one of the areas in which benefit of lessons learned may be realized is spent fuel management. While experience might produce benefits in this area, suggesting that this may somehow reduce the cost of decommissioning the VY Station is inconsistent with other testimony. Specifically, Mr. Cloutier testifies that he expects the spent fuel management costs to be ultimately borne by DOE. If this assumption becomes true, then experience that reduces spent fuel management costs will not reduce Entergy's cost for decommissioning the VY Station, but instead would simply reduce the cost borne by DOE.

Q68. What did you conclude concerning Mr. Cloutier's opinion regarding potential savings from fleet operation of spent fuel storage?

A68. Mr. Cloutier has testified that there could be financial advantage to Entergy fleet management of long-term fuel storage "once decommissioning has been completed." Storage of spent fuel after decommissioning is complete applies to only three of the six 2012 estimate scenarios. The benefit suggested has no applicability to the other scenarios. Additionally, as I have noted previously, Mr. Cloutier believes spent fuel storage costs will be recovered from the DOE. If Mr. Cloutier is correct, there would be no reduction in Entergy's costs even in the three scenarios in which the posited situation exists.

Q69. Do you agree that allowing more time for maturation of DOE spent fuel programs would offer potential benefits with regard to VY Station decommissioning costs?

A69. Mr. Cloutier has testified that an additional 20-year period of operation of the VY Station will provide additional time for maturation of the DOE spent fuel program plans and that this would provide greater assurance that the decommissioning of the VY Station can be achieved in a timely and cost effective manner. The nature of the benefit being suggested by Mr. Cloutier is unclear. The start of decommissioning is not dictated by progress in DOE planning. The start and completion of the NRC-defined decommissioning, which represents the majority of the estimated costs, can be completed, except for the dry fuel storage facility dismantlement, independent of the start of DOE acceptance. While the spent fuel storage work might benefit if Mr. Cloutier is correct in his opinion that all spent fuel management costs will be recovered from DOE, any benefit gained with regard to spent fuel management would not benefit Entergy or Vermont.

Q70. Do you have any comments concerning the potential for recovery of all spent fuel costs from DOE?

A70. As noted several times, Mr. Cloutier testifies that he expects Entergy to recover all spent fuel management costs from DOE. Mr. Cloutier assumes such recovery would occur with only minimal delay after the costs were incurred. Such an assumption does not affect the 2012 estimate, but rather the funding analysis. To the extent that the amount assumed to be recovered is based on the allocation of costs in the 2012 estimate, it is only as reasonable and reliable as the allocation of costs in the estimate. Entergy has referred to court rulings in litigation with the DOE as basis for assuming recovery of spent fuel costs, but Entergy has not identified or properly evaluated all of the circumstances of those rulings. Recovery of any costs to date, aside from those utilities that have settled with DOE, have been delayed for many years after those costs were originally incurred. For example, in 1998 Yankee Rowe sued for costs incurred through 2001, yet recovery of those costs was delayed in excess of ten years. Other utilities have faced similar delays in recovery of costs. When costs have been recovered, moreover, it has not always been on a dollar-for-dollar basis. Courts have excluded recovery for costs that it deems the plant owner would have incurred even if DOE had met its obligations under its contracts to recover spent fuel from the plant.

Q71. Do you have any other concerns with Mr. Cloutier's discussion of potential savings from recovery of spent fuel storage costs?

A71. Entergy has not explained the significance of the ruling by the Court of Appeals for the Federal Circuit with regard to spent fuel loading costs. Specifically, the Court ruled that the cost of loading fuel for transfer to DOE that the utility would have incurred had DOE performed had not been avoided, but instead was deferred. The Court also stated that these deferred loading costs would have to be paid by the utility at the time DOE performs. Although the value of these deferred responsibilities will be established in the future, the cost could be as much as the dry cask loading cost. This deferred obligation to DOE could be on the order of $10 to $20 million.

Q72. Does this conclude your testimony?

A72. Yes it does, at this time.